EARTHQUAKE SERVICES

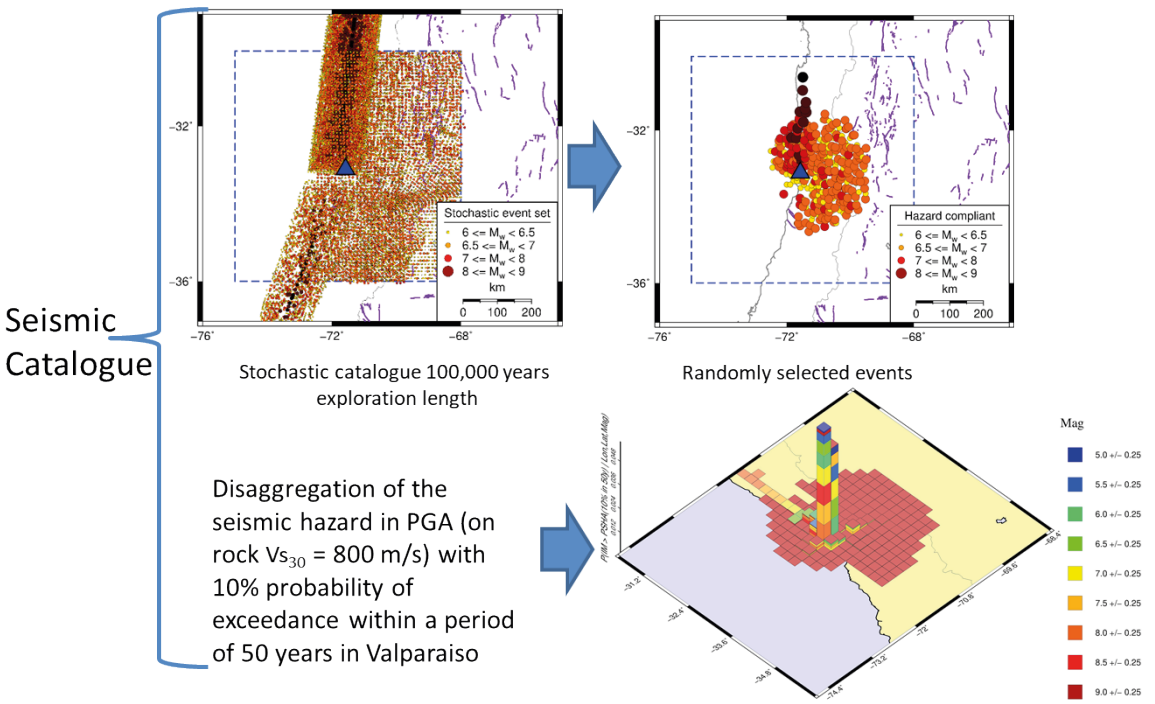
Constructing representative seismic scenarios

RELEVANCE IN THE REGION

The Central Chile area including **Valparaiso, has been hit by powerful damaging earthquakes**, e.g. The 1906 Mw 8.2 caused great damage and the 1985 Mw 7.8 event destroyed 70.000 houses and caused losses of about $1.8 billion. The 2010 Mw 8.8 earthquake caused damage to some buildings in Viña del Mar. Lastly, the 2017 Mw 6.9 was strongly felt in Valparaiso. Regarding the other study area, in other recent research work, **Lima has been identified as the capital city exposed to the highest seismic hazard in South America**. One example of these damaging events in the city is the 1746 Mw 8.8 earthquake that destroyed Lima completely.

SEISMIC CATALOGUES

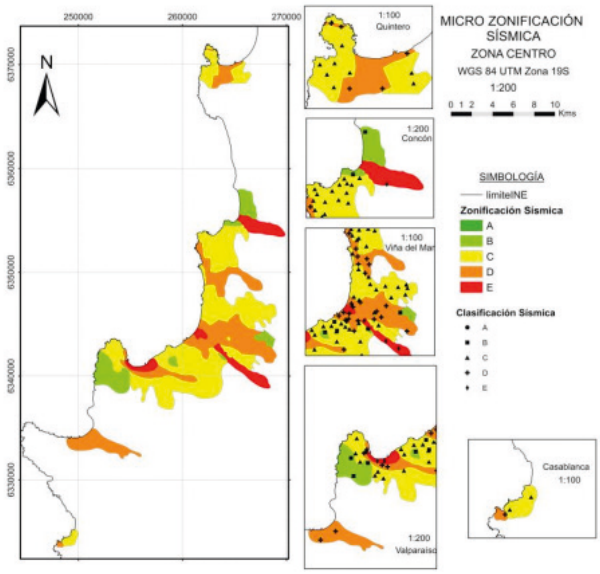
In order to explore the cumulated damage for earthquake and tsunami in the study areas, first, we need to create suitable scenarios to be explored and obtain their respective seismic intensity distributions. **Seismic catalogues for every Valparaiso and Lima study areas have been constructed**. Every seismic event of the catalogue is described by parameters as moment magnitude, hypocentral depth, rake, and dip angles. **Every event is a potential scenario likely to occur in the future according to probabilistic seismic hazard analysis** and its disaggregation.



Example of the generation of a stochastic earthquake catalogue for 100,000 years exploration length based on the hazard disaggregation in Valparaiso, Chile.

INCORPORATION OF LOCAL SEISMIC MICROZONING MODELS

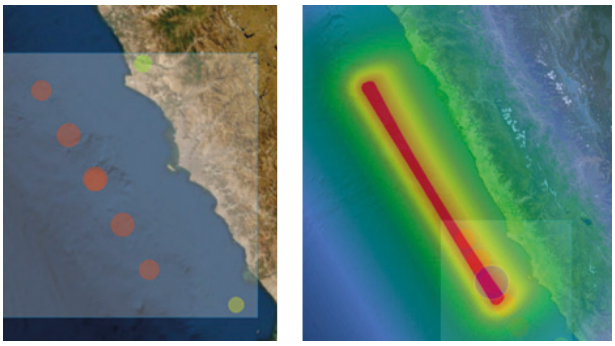
Seismic site conditions related to ground movement amplifications have been partially included. This has been possible thanks to the cooperation with CIGIDEN in Chile and the Ministry of Housing in Peru. We have compiled the average shear wave velocity values for the upper 30 m (Vs_{30} (m/s)) of the local seismic **microzonations carried out by local experts in the past through geophysical field campaigns**. When such information was not available at some sites, it was supplemented with the Vs_{30} values reported by the USGS from the topographic proxy.



Seismic microzonation data from the SIGAS platform of CIGIDEN that has been integrated into the Vs_{30} grid model as input for the Shakyground web service. Courtesy of Mendoza et al, 2018 from the original version in Spanish.

THE SPATIAL DISTRIBUTION OF SEISMIC GROUND MOTION INTENSITIES

For every earthquake scenario, seismic ground motion fields are computed online through the web service ShakyGround that is used by the RIESGOS demonstrator to display the spatially distributed values from every rupture. **Suitable analytical models for the subduction tectonic environment in the form of a ground motion prediction equation** (GMPE) are used for this purpose. The locally constructed (Montalva et al, 2017) GMPE is used.



Simulated seismic ground motion intensity (PGA (g)) in Lima accounting the Vs_{30} proxy using the ShakyGround web service.

New strategies are currently being developed to address ground motion amplification models adapted to large-scale risk calculations and **include spatially correlated ground motion fields** that serve as appropriate intensity measures for fragility functions in the vulnerability assessment stage. This is a relevant aspect that must be integrated in future stages to obtain more significant loss estimates and explore the uncertainties associated with the randomness of the spatial distribution of the seismic ground motions.

More information about the project:
www.riesgos.de

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